What Is Claimed Is:

1. A method for modifying a hexahedral volume mesh, comprising:

generating a sheet of hexahedral elements to remove from a volume mesh, wherein said mesh includes a plurality of three-dimensional (3D) hexahedrons each having six quadrilateral faces and eight nodes, each node formed at three intersecting edges, and wherein said sheet includes a subset of the plurality of 3D hexahedrons;

determining one or more sets of nodes for merging together within said sheet, each set satisfying a predetermined merging threshold;

merging the nodes for each determined set of nodes; and

removing the sheet of hexahedrons from said volume mesh.

2. The method of Claim 1, wherein the six quadrilateral faces for each 3D hexahedron include three sets of opposing faces, and wherein generating a sheet to remove includes:

a) selecting a first hexahedron to remove, the selected hexahedron having a first set of opposing faces, the first set including a first opposing face and a second opposing face;

b) determining a first neighboring hexahedron, the first neighboring hexahedron sharing the first opposing face with the selected hexahedron;

c) selecting the first neighboring hexahedron to remove, the first neighboring hexahedron having another face opposite the shared first opposing face;

d) repeating steps b) and c) until a predetermined sheet edge threshold being satisfied;

e) determining a second neighboring hexahedron, the second neighboring hexahedron sharing the second opposing face with the selected hexahedron;

f) selecting the second neighboring hexahedron to remove, the second neighboring hexahedron having another face opposite the shared second opposing face;

g) repeating steps e) and f) until the predetermined sheet edge threshold being satisfied;

h) grouping all selected hexahedrons into a first column of hexahedrons;

i) selecting the first hexahedron, the selected hexahedron having a second set of opposing faces, the second set including a third opposing face and a fourth opposing face;

j) determining a third neighboring hexahedron, the third neighboring hexahedron sharing the third opposing face with the selected hexahedron;

k) selecting the third neighboring hexahedron to remove;

l) repeating steps a) through h) until a second column of hexahedrons is grouped;

m) selecting the first hexahedron;

n) determining a fourth neighboring hexahedron, the fourth neighboring hexahedron sharing the fourth opposing face with the selected hexahedron;

o) selecting the fourth neighboring hexahedron to remove;

p) repeating steps a) through h) until a third column of hexahedrons is grouped;

q) repeating steps a) through p) until the sheet edge threshold being satisfied; and

r) grouping all columns of hexahedrons into the sheet to remove.

3. The method of Claim 1, wherein generating a sheet to remove includes:

a) selecting a hexahedron to remove, the selected hexahedron having three sets of opposing faces from the six quadrilateral faces, each set comprising a first opposing face and a second opposing face;

b) determining a neighboring hexahedron to remove, the neighboring hexahedron sharing one face with the selected hexahedron;

c) repeating step b) until all neighboring hexahedrons have been determined;

d) selecting the neighboring hexahedron to remove;

e) repeating steps a) through d) until all hexahedrons in the sheet to remove have been found.

4. The method of Claim 1, wherein determining one or more sets of nodes for merging together includes:

a) selecting a hexahedron in the sheet to remove, the selected hexahedron having three sets of opposing faces from the six quadrilateral faces, each set comprising a first opposing face and a second opposing face;

b) identifying the one set of opposing faces that are not shared by another hexahedron in the sheet, wherein each face includes four nodes;

c) pairing the nodes in the first opposing face with the nodes in the second face;

d) identifying each node pair for merging; and

e) repeating steps a) through d) until all node pairs in the sheet have been identified for merging.

5. The method of Claim 4, wherein determining one or more sets of nodes for merging together includes:

a) selecting hexahedrons in a sheet self-intersection to remove;

b) identifying sets of nodes at the sheet self-intersection for merging into a single node; and

c) repeating steps a) through b) until all sets of nodes at the sheet self-intersection have been identified for merging.

6. The method of Claim 1, wherein determining one or more sets of nodes for merging together within said sheet includes:

a) determining an owning geometric entity for each node in each set of nodes for merging;

b) determining the owning geometric entity with the lowest dimension;

c) comparing all other owning geometric entities with the lowest dimension owning geometric entity;

d) determining whether to merge together said sets of nodes in accordance with said comparing and said predetermined merging threshold.

7. The method of Claim 6, wherein merging the nodes for each determined set of nodes includes:

a) merging each node in the set into the node with the lowest dimension owning geometric entity for owning geometric entities with different dimensions, wherein the lowest dimension owning geometric entity is a subset of the other owning geometric entities; and

b) merging each node in the set into an average location of all the nodes for owning geometric entities with the same dimension, wherein each owning geometric entity has at least one dimension.

8. The method of Claim 1, wherein merging the nodes for each determined set of nodes includes:

a) merging each node in the set into the node with the lowest dimension owning geometric entity for owning geometric entities with different dimensions, wherein the lowest dimension owning geometric entity is a subset of the other owning geometric entities; and

b) merging each node in the set into an average location of all the nodes, for owning geometric entities with the same dimension; wherein each owning geometric entity has at least one dimension.

9. A method for generating a hexahedral volume mesh by extracting a sheet of hexahedrons, comprising:

a) generating an initial hexahedral volume mesh, wherein the mesh includes a plurality of three-dimensional (3D) hexahedrons, each 3D hexahedron having six quadrilateral faces and eight nodes, each node formed at three intersecting edges;

b) determining an area of poor mesh quality in the initial mesh;

c) generating a sheet of poor mesh quality from said area to remove, wherein the sheet includes a subset of the plurality of 3D hexahedrons;

d) determining one or more sets of nodes for merging together, each set satisfying a predetermined merging threshold;

e) merging the nodes for each set of nodes; and

f) extracting the sheet from the initial hexahedral mesh.

10. The method of Claim 9, wherein identifying a sheet includes using a dual of the initial hexahedral mesh.

11. The method of Claim 9, wherein the initial hexahedral mesh is selected from the group consisting of an all-hexahedral swept mesh, multiple all-hexahedral swept meshes for a subdivided geometric entity, a quadrilateral mesh from a source surface to a target surface, and combinations thereof.

12. The method of Claim 9, wherein determining an area of poor mesh quality includes identifying an inverted node.

13. The method of Claim 9, wherein the determining an area of poor mesh quality includes identifying a self-intersecting sheet.

14. The method of Claim 9, wherein determining an area of poor mesh quality includes identifying a valent node to remove.

15. The method of Claim 9, wherein the six quadrilateral faces for each 3D hexahedron include three sets of opposing faces, and wherein generating a sheet to remove includes:

a) selecting a first hexahedron to remove, the selected hexahedron having a first set of opposing faces, the first set including a first opposing face and a second opposing face;

b) determining a first neighboring hexahedron, the first neighboring hexahedron sharing the first opposing face with the selected hexahedron;

c) selecting the first neighboring hexahedron to remove, the first neighboring hexahedron having another face opposite the shared first opposing face;

d) repeating steps b) and c) until a predetermined sheet edge threshold being satisfied;

e) determining a second neighboring hexahedron, the second neighboring hexahedron sharing the second opposing face with the selected hexahedron;

f) selecting the second neighboring hexahedron to remove, the second neighboring hexahedron having another face opposite the shared second opposing face;

g) repeating steps e) and f) until the sheet edge threshold being satisfied;

h) grouping all selected hexahedrons into a first column of hexahedrons;

i) selecting the first hexahedron, the selected hexahedron having a second set of opposing faces, the second set comprising a third opposing face and a fourth opposing face;

j) determining a third neighboring hexahedron, the third neighboring hexahedron sharing the third opposing face with the selected hexahedron;

k) selecting the third neighboring hexahedron to remove;

l) repeating steps a) through h) until a second column of hexahedrons is grouped;

selecting the first hexahedron;

n) determining a fourth neighboring hexahedron, the fourth neighboring hexahedron sharing the fourth opposing face with the selected hexahedron;

o) selecting the fourth neighboring hexahedron to remove;

p) repeating steps a) through h) until a third column of hexahedrons is grouped;

q) repeating steps a) through p) until the sheet edge criterion is met; and

r) grouping all columns of hexahedrons into the sheet to remove.

16. The method of Claim 9, wherein generating a sheet to remove includes:

a) selecting a hexahedron to remove, the selected hexahedron having three sets of opposing faces from the six quadrilateral faces, each set comprising a first opposing face and a second opposing face;

b) determining a neighboring hexahedron to remove, the neighboring hexahedron sharing one face with the selected hexahedron;

c) repeating step b) until all neighboring hexahedrons have been found;

d) selecting the neighboring hexahedron to remove;

e) repeating steps a) through d) until all hexahedrons in the sheet to remove have been found.

17. The method of Claim 9, wherein determining one or more sets of nodes for merging together includes:

a) selecting a hexahedron in the sheet to remove, the selected hexahedron having three sets of opposing faces from the six quadrilateral faces, each set comprising a first opposing face and a second opposing face;

b) identifying the one set of opposing faces that are not shared by another hexahedron in the sheet, wherein each face comprises four nodes;

c) pairing the nodes in the first opposing face with the nodes in the second face;

d) identifying each node pair for merging; and

e) repeating steps a) through d) until all node pairs in the sheet have been identified for merging.

18. The method of Claim 17, wherein determining one or more sets of nodes for merging together includes:

a) selecting hexahedrons in a sheet self-intersection to remove;

b) identifying sets of nodes at the sheet self-intersection for merging into a single node; and

c) repeating steps a) through b) until all sets of nodes at the sheet self-intersection have been identified for merging.

19. The method of Claim 9, wherein determining one or more sets of nodes for merging together includes:

a) determining an owning geometric entity for each node in each set of nodes for merging;

b) determining the owning geometric entity with the lowest dimension;

c) comparing all other owning geometric entities with the lowest dimension owning geometric entity; and

d) determining whether to merge together said sets of nodes in accordance with said comparing and said predetermined merging threshold.

20. The method of Claim 19, wherein merging the nodes for each predetermined set of nodes includes:

a) merging each node in the set into the node with the lowest dimension owning geometric entity for owning geometric entities with different dimensions, wherein the lowest dimension owning geometric entity is a subset of the other owning geometric entities; and

b) merging each node in the set into an average location of all the nodes for owning geometric entities with the same dimension, wherein each owning geometric entity has at least one dimension.

21. The method of Claim 9, wherein merging the nodes for each determined set of nodes includes:

a) merging each node in the set into the node with a lowest dimension owning geometric entity for owning geometric entities with different dimensions, wherein the lowest dimension owning geometric entity is a subset of the other owning geometric entities; and

b) merging each node in the set into an average location of all the nodes for owning geometric entities with the same dimension, wherein each owning geometric entity has at least one dimension.

22. A sheet extractor for modifying a hexahedral mesh, comprising:

a controller for performing the steps of:

generating a sheet of hexahedrons to remove from a hexahedral mesh, wherein the mesh includes a plurality of three-dimensional (3D) hexahedrons, each 3D hexahedron comprising eight nodes, and wherein said sheet including a subset of said plurality of 3D hexahedrons; and

determining one or more sets of nodes from said sheet for merging together, each determined set satisfying a predetermined merging threshold.

23. The sheet extractor of Claim 22, wherein said controller further performing the steps of:

selecting a first hexahedron to remove from said sheet, including three sets of opposing faces, wherein each set includes a first opposing face and a second opposing face;

selecting a neighboring hexahedron to remove, comprising three sets of opposing faces, the neighboring hexahedron sharing one face with the selected first hexahedron; and

selecting a plurality of other neighboring hexahedrons to remove, each neighboring hexahedron comprising three sets of opposing faces, each neighboring hexahedron sharing a face with another hexahedron.

24. The sheet extractor of Claim 23, wherein determining one or more sets of nodes includes:

determining four node pairs for each hexahedron including:

determining four nodes associated with the first opposing face; and

determining four additional nodes associated with the second opposing face, wherein each node in the first opposing face being paired with a node in the second opposing face.

25. The sheet extractor of Claim 22, wherein determining one or more sets of nodes includes:

determining a specific owning geometric entity for each node to be merged;

determining a lowest dimension owning geometric entity for each set of merge nodes;

determining a dimension associated with each owning geometric entity;

merging each node in the set into a node with the lowest dimension owning geometric entity for owning geometric entities with different dimensions, wherein the lowest dimension owning geometric entity is a subset of other owning geometric entities;

merging each node in the set into an average location for all nodes for owning geometric entities with the same dimension, wherein each owning geometric entity has at least one dimension.

26. A method for modifying a volume mesh, comprising:

connecting a plurality of rows of elements of a volume mesh using connecting lines, where said connecting lines, together with associated planes, form a plurality of three-dimensional regions, said plurality of three-dimensional regions forming a sheet of volume mesh elements for removal from said mesh;

associating each volume mesh element with at least one set of nodes for merging together, each set satisfying a predetermined merging threshold;

merging said at least one set of nodes together for each element and removing said sheet to produce a modified form of said volume mesh.

27. A machine-readable medium having stored thereon a plurality of executable instructions, the plurality of instructions comprising instructions to:

connect a plurality of rows of elements of a volume mesh using connecting lines, where said connecting lines, together with associated planes, form a plurality of three-dimensional regions, said plurality of three-dimensional regions forming a sheet of volume mesh elements for removing from said mesh;

associate each volume mesh element with at least one set of nodes for merging together, each set satisfying a predetermined merging threshold;

merge said at least one set of nodes together for each element and removing said sheet to produce a modified form of said volume mesh.

28. A method for modifying a volume mesh, comprising:

connecting a plurality of rows of elements of a volume mesh using connecting lines, where said connecting lines, together with associated planes, form a plurality of three-

dimensional regions, said plurality of three-dimensional regions forming a sheet of volume mesh elements, each mesh element including a plurality of surfaces;

determining at least one node linking a plurality of surfaces in said sheet using a predetermined algorithm;

disconnecting a plurality of said connecting lines, together with a plurality of said associated planes, at said at least one node and removing a portion of said plurality of connecting lines, together with a portion of said plurality of associated planes, in a predetermined direction away from said point;

reconnecting a remaining portion of said plurality of connecting lines, together with a remaining portion of said plurality of associated planes, at said at least one node to produce a modified form of said volume mesh.

29. A machine-readable medium having stored thereon a plurality of executable instructions, the plurality of instructions comprising instructions to:

connect a plurality of rows of elements of a volume mesh using connecting lines, where said connecting lines, together with associated planes, form a plurality of three-dimensional regions, said plurality of three-dimensional regions forming a sheet of volume mesh elements, each mesh element including a plurality of surfaces;

determine at least one node linking a plurality of surfaces in said sheet using a predetermined algorithm;

disconnect a portion of said connecting lines, together with a portion of said associated planes, at said at least one node and removing said portion in a predetermined direction away from said point;

reconnect a remaining portion of said connecting lines, together with a remaining portion of said associated planes, at said at least one node to produce a modified form of said volume mesh.